Research Paper

Association of Traffic Air Pollution with Respiratory Symptoms among Adolescents in Yazd, Iran: Based on Global Asthma Network 2020 Cross-sectional Study

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ABSTRACT

Background: The relationship between Traffic Air Pollution and asthma symptoms in adolescents is controversial.

Objectives: This study investigates the impact of traffic air pollution on asthma symptoms among adolescents aged 13-14 years in Yazd City, Iran.

Methods: As part of the Global Asthma Network in Yazd City, Iran, a cross-sectional study was conducted in 2020 involving 5141 adolescents from 48 schools selected via cluster sampling. The study assessed the association between self-reported truck traffic exposure and respiratory symptoms.

Results: Approximately, 31% of adolescents reported frequent exposure to heavy goods vehicles, with a significant association found between truck traffic and asthma symptoms (P=0.001). However, no significant associations were observed between housing types, floor numbers, and asthma (P=0.15 and P=0.11, respectively). Additionally, a significant relationship existed between truck traffic intensity and severe asthma symptoms (P=0.18).

Conclusions: Traffic-related air pollution had a notable impact on asthma symptoms, particularly among male adolescents in Yazd City, Iran.

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Introduction

Asthma is the most common inflammatory disease that poses a significant burden on both clinical and public health [1, 2]. Recent reports have highlighted asthma as the 12th leading cause of death among children under 5 years of age, and the 20th cause of death in children between 5 and 14 years of age [3]. The prevalence of asthma varies widely across countries at different levels of development. Over the past years, there has been an increase in the incidence of asthma particularly among children who are at a higher risk of developing the condition [4]. The rapid growth of urban population, industrialization, and the intensification of road traffic present significant challenges to ambient air quality [5]. Studies have identified those vehicles as the primary source of air pollution in most cities [5, 6]. Children with respiratory conditions, such as allergies, asthma, and chronic obstructive pulmonary disease are particularly vulnerable to adverse respiratory effects from exposure to traffic-related air pollutants [7, 8]. While there is mounting evidence linking living near heavy traffic to higher rates of asthma, some well-designed studies have found only weak or no associations [9, 10]. Given the ongoing debate surrounding the role of air pollution in the development of new-onset asthma, and its contribution to the current pandemic [11, 12], we conducted a cross-sectional study to investigate the impact of exposure to traffic-related air pollutants on respiratory symptoms among asthmatic individuals in Yazd City, Iran.

Methods

This cross-sectional study involved 7214 adolescents aged 13 to 14 years as a part of the Global Asthma Network 2020 survey, in Yazd Province, Iran. A total of 48 schools were selected through cluster sampling from a total of 48 private and public schools catering to both genders. Informed consent was obtained from participants before completing the electronic questionnaire. The global asthma network questionnaire, which is derived from the international study of asthma and allergies in childhood questionnaire, includes questions about allergic symptoms and related risk factors. The details of the study method referred to previously published [13]. The data on wheezing in the past year, nighttime dry cough, asthma severity, physician-confirmed asthma diagnosis, and exposure to heavy vehicle traffic were collected using the translated Global Asthma Network questionnaire. Children with exposure to smoking, pets, or environmental tobacco smoke were excluded from the study to avoid confounding factors.

Statistical analyses

Data analysis was performed using the SPSS software, version 20. The t-test was used to compare mean differences between quantitative variables. Meanwhile, the Pearson chi-square test was used to assess associations between categorical variables. A $P<0.05$ was considered statistically significant. The results from the logistic regression model were presented as odds ratio (OR) with corresponding 95% confidence intervals (CI).

Result

A total of 7214 children in the 13–14 years of age groups were included with a response rate of 71%. Among the 5141 students, 3069(59.7%) were females and 2072(40.3%) were males. In this study, 9% of participants reported current asthma symptoms, including wheezing in the past year, while 12.4% reported nighttime dry cough and wheezing after exercise was observed in 15.9% of participants (Table 1).

Approximately 31% of the children were exposed to frequent and constant heavy goods vehicle traffic. A statistically significant relationship was found between truck traffic and asthma symptoms (P=0.001). Notably, in the multivariate analysis, this relationship remained significant for individuals living on streets with frequent or constant heavy good goods vehicle, traffic compared to those residing on streets where these vehicles did not pass. There was no statistically significant relationship between housing types, floor numbers, and asthma (P=0.15 and P=0.11 respectively) (Table 2).

There was no statistically significant relationship observed in children, with more asthma symptoms who were exposed to higher-intensity truck traffic (P=0.18) (Table 3).

The association between traffic air pollution and asthma in the logistic regression model is detailed in Table 4. In the multivariable model, intense truck traffic significantly increased asthma symptoms (adjusted OR=2.19 [95% CI, 1.33%, 3.62%]).

Discussion

The present study identified a significant relationship between high traffic densities and the incidence of respiratory symptoms, aligning with findings from previous studies that have also reported an increase in asthma symptoms with greater exposure to traffic [14-24]. A recent meta-analysis further supported this association by demonstrating a link between higher ex-

Table 1. Prevalence of asthma symptoms in the aged group of 13-14 years by sex

Asthma Symptoms		No. (%)			P
		Female	Male	Total	
Wheezing in the past 12 months (current wheezing)	Yes	247(8)	214(10)	461(9)	0.7
	No	2822(92)	1858(90)	4680(91)	
Exercise-induced wheeze in the past 12 months	Yes	474(15.4)	342(16.5)	816(15.9)	0.3
	No	2595(84.6)	1730(83.5)	4325(84.1)	
Night dry cough without cold in the past 12 months	Yes	361(11.8)	274(13.2)	635(12.4)	0.1
	No	2708(88.2)	1798(86.8)	4506(87.6)	

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posure to truck traffic and childhood asthma [25]. In a study by Janssen et al. positive associations were found between truck traffic density and other indicators of traffic-related air pollution and childhood asthma [26]. However, the consistency of the relationship between traffic exposure and asthma symptoms across different studies is not uniform. Some authors have reported no significant effects, as seen in a study by Pujades-Rodriguez et al. which even suggested a protective effect in 7- to 15-year-old children [27]. A study in New York City, United States, revealed that exposure to high traffic density was associated with an increased risk of asthma emergency department visits, with certain subgroups potentially at higher risk due to physiological susceptibility. Despite adjustment for traffic exposures, racial and demographic disparities persisted among this low-income population, indicating that environmental risk factors, such as local traffic, can disproportionately impact vulnerable groups [28]. As evidenced by a study in Spain the odds of developing severe or exercise-induced asthma were three times higher in 6-7 year-old boys living on streets with frequent heavy-duty vehicle traffic, as opposed to those living on streets where these vehicles do not pass. There was no association between truck traffic and asthma symptoms among girls and 13-14 year-old boys. These findings appear to suggest a differential effect of truck traffic on the development of asthma, particularly in young boys [29]. This study indicated a stronger effect relationship between the severity of asthma and the frequent passing of the truck in the male gender; consistent with previous research findings [29-31]. This gender difference could be attrib-

Table 2. Association between traffic air pollution and asthma

Variables		No. (%)		P
		Asthmatics (n=1350)	Non-asthmatics (n=3791)	
Truck traffic on the street of the residence	Never	109(16.8)	540(83.2)	0.001
	Seldom	344(20.5)	1336(79.5)	
	Frequent	106(28.4)	267(71.6)	
	Constant	27(31)	60(69)	
Type of house	Villa	372(20.4)	1450(79.6)	0.15
	Apartment	214(22.1)	753(77.9)	
House floor	Underground	47(22.4)	163(77.6)	0.11
	Ground level	274(19.4)	1136(80.6)	
	Other	265(22.7)	904(77.3)	

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Table 3. Association between traffic air pollution and asthma severity

Variables		No. (%)		P
		Asthma Severity		
		Current Asthma	Severe Asthma	
Truck traffic on the street of the residence	Never	644(99.2)	5(8)	0.18
	Seldom	1657(98.6)	23(1.4)	
	Frequent	364(97.6)	9(2.4)	
	Constant	86(98.9)	1(1.1)	
Type of house	Villa	1801(98.8)	21(1.2)	0.12
	Apartment	950(98.2)	17(1.8)	
House floor	Underground	210(100)	0	0.17
	Ground level	1391(98.7)	19(1.3)	
	Other	1150(98.4)	19(1.6)	

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uted to smaller airway sizes in boys at this age, leading to increased airway reactivity [32, 33]. Cultural and social factors may also contribute to lower acceptance of an asthma diagnosis among females in our country. While some evidence has suggested larger estimates for girls in other studies, our findings highlight a greater impact on males [19, 33, 34]. In addition, our study did not any significant association between traffic exposures and the severity of asthma, consistent with findings reported by other authors [35, 36]. In Shandong, China, a study showed that traffic-related facilities in proximity to residential areas appear to be risk factors for the development of asthma, wheezing, and rhinitis among urban children [37]. Another cross-sectional analysis of a multiracial cohort of children from the environmental influences on child health outcomes cohort revealed a significant association between reported neighborhood traffic and asthma/asthma-like symptoms, both in line with the findings of this study [38].

Conclusion

The results of this study suggest that exposure to traffic-related air pollutants is associated with an increase in asthma symptoms, with the impact varying depending on the sex of the individuals.

Study limitations

This study faced some limitations as the data was collected through a questionnaire without objective measurements of exposure or disease. Additionally, information regarding contaminants from sources other than traffic, such as biomass combustion or certain industries, was not obtained. In conclusion, the results

Table 4. The association between truck traffic and asthma in the logistic regression model

Variables		Asthma		
		OR	P	95% CI
Truck traffic on the street of the residence	Never			
	seldom	1.25	0.06	0.98-1.59
	Frequent	1.89	0.001	1.39-2.57
	Constant	2.19	0.002	1.33-3.62

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Ethical Considerations

Compliance with ethical guidelines

This study received approval from the Ethics Committee of Shahid Sadoughi University of Medical Sciences, Yazd, Iran (Code: IR.SSU.MEDICINE.REC.1400.235).

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Authors contributions

Conceptualization, and data curation: Nasrin Behniafard and Hosein Ghareghahi; Formal analysis: Farimah Shamsi; Funding acquisition: Nasrin Behniafard, and Zahra Nafei; Writing the original draft: Azam Golzar; Methodology, visualization, review and editing: Abdolhamid Jafari nodoshan.

Conflicts of interest

The authors declared no conflict of interest.

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